

MOBILE PHONES

— TIME TO TAKE PRECAUTIONS —

Recent medical findings and recommendations from UK government reports suggest that radiation emission guidelines should be made more stringent and that mobile phone use should be minimised.

by Simon Best, MA © 2000

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[Editor's Note: This article refers to a number of research studies involving animals. We wish to advise that we at NEXUS do not condone or support the validity, efficacy or morality of animal experimentation or vivisection.]

By the end of November, a leaflet on mobile phone health hazards will have been made available at point of sale and to the general public in Britain. This significant development puts the UK government in the lead in reacting to the growing public and scientific concern over the possible hazards from mobile phone radiation.

However, since the leaflet is being put together by the Department of Health (DoH), the National Radiological Protection Board (NRPB) and the mobile phone industry, one will have to wait to see whether it does proper justice to the evidence or tries to downplay it. Whatever the case, such developments are keeping the issue continually in front of the public and the media in Britain.

The leaflet is just one of the major outcomes of the Stewart Report—the Report of the Independent Expert Group on Mobile Phones, chaired by Sir William Stewart, FRS, Chairman of Tayside University Hospitals NHS Trust, Dundee, entitled "Mobile Phones and Health" and published in May.¹ Another is that in August the Department of Education wrote to every school in the country, requesting them to make children aware of possible hazards from excessive use of mobile phones and to encourage them to reduce their use. No such warning has yet been issued by any other Western country.

Most significant among the Stewart Report's many recommendations was its adoption of a "precautionary approach" regarding the use of mobile phones, especially among children, with the advice that the industry cease promoting them to children. It recommended that a leaflet be sent to every household explaining the health issues, and that this should also be made available at the point of sale.

It also recommended that a major, well-funded research program be set up, and the government has since announced that it will launch a new program by the end of November. Specific Absorption Rate (SAR) information on every phone at the point of sale, full planning permission for all new masts and a review of the evidence in three years' time (or before, if warranted) were among other recommendations of the Report, which also included criticisms of the NRPB. How many of these recommendations will be adopted will have become clear by the end of the year, although the Department of Health has now accepted most of them.

One of the chief criticisms of the Report itself is that it left out certain major pieces of research in drawing its conclusions about the evidence for radiofrequency (RF) hazards. This has been assessed in detail elsewhere,² but certainly many would disagree with its conclusion that "The balance of evidence suggests that exposures to RF radiation below NRPB...guidelines do not cause adverse health effects to the general population"(1.17).

Besides the symptoms reported by users, ranging from heating sensation and skin irritation, headache, eye and sleep problems to short-term memory loss, disorientation and brain tumour, there is a growing body of research that cannot be dismissed.

The industry, however, continues to insist that there is insufficient evidence, and that the phones are "safe" and the radiation they emit falls well within the guidance laid down by the UK's regulatory authority, the NRPB—which currently refuses to acknowledge any need to change its guidelines and has stuck rigidly to its position of only taking account of heating effects, despite growing evidence and criticism.

THERMAL VERSUS NON-THERMAL EFFECTS

The whole of the debate over mobile phones and, indeed, concerning other sources of non-ionising radiation such as VDUs, power lines, etc., centres on the evidence for and against thermal versus non-thermal biological effects.

A thermal, or heating, effect on tissue is currently accepted by most scientists in this area to be the only significant way by which electromagnetic fields (EMFs) can pose a hazard to the body; and thus all guidance, both national and international, continues to be based on this assumption. Even the Stewart Report has not challenged this view.

However, a growing body of evidence and opinion over the last decade indicates that effects can occur at levels well below that at which tissue begins to heat up, and that these non-thermal effects can pose significant risk. But before some of this is discussed, it is important to understand how a mobile phone basically works.

The frequencies used by digital (as opposed to the older analogue) mobile phones (900 megahertz for the GSM system used by Vodafone and Cellnet, and 1800 MHz for the PCN system used by Orange and One2One) fall into the microwave region of the electromagnetic spectrum. This frequency range, as well as the much lower range used by VDUs and power lines, etc., is termed "non-ionising" because the frequencies do not contain sufficient energy to strip electrons from atoms. By contrast, beta and gamma radiation, from nuclear fission and other sources, *does* have enough energy to do this and is hence termed "ionising", and it poses well-known, accepted hazards. It is partly this distinction that has caused many orthodox scientists to believe that non-ionising radiation implicitly posed little hazard, except in its capacity to heat tissue.

But, in the case of mobile phones, there is a further reason for concern in that the signal is "pulsed". This means that the main

frequency "carries" another signal—in this case, at 217 Hz—which generates a regular, low-frequency pulsing effect into the brain. In fact, there are further subtle, harmonic pulses and fields to which the user is exposed. It is these, as well as other parameters of the signal, which are causing concern and are not properly taken into account in current guidance advice.

The proposed new TETRA system, mainly for the emergency services, some corporate networks and the London Underground, is especially alarming in this respect, since it uses not only a 420 MHz signal (producing a waveform that maximises radiation absorption for three-to-six-year-old children) but also a pulse at 17 Hz, right in the brain's beta rhythm! This, despite a complete lack of research on possible health effects.

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SIGNIFICANT NEW FINDINGS

It is not possible to go into great detail about recent research findings (these are covered in depth in issues of *Electromagnetic Hazard & Therapy*), but some recent studies are significant.

In 1998, Dr Kjell-Hansson Mild at the National Institute of Working Life in Umeå, Sweden, reported a study of 11,000 users in Norway and Sweden, comparing symptoms according to duration of use of both analogue and GSM phones.³ Concentrating on the

latter (since they represent 95% of phones sold), he found a significant dose-response relationship between reported symptoms (fatigue, headache, warmth behind or on ear, burning skin sensation) and duration of use, covering less than 2 minutes, 2–15 minutes, 15–60 minutes and over 1 hour. For example, those Swedes using a phone for more than an hour were 22 times more likely to report an increase in warmth behind the ear than those using them for less than 2 minutes; the equivalent figure for Norwegians was 16-fold (see table 1).

These results clearly show that a heating effect does occur, although how far it penetrates into the brain and whether this effect itself is responsible for all the reported symptoms is still unclear.

Other research, also in Sweden, by Professor Leif Salford at Lund University, shows that radiation at mobile phone frequency can change the blood-brain barrier that normally allows certain chemicals to cross and keeps others out. Professor Salford observed that after only two minutes' exposure to mobile phone intensities, rats displayed changes in the permeability of the blood-brain barrier.⁴ This is clearly a worrying finding, suggesting a non-thermal effect as has been claimed.

In the USA, Professor Henry Lai and Dr Narandra Singh, at the University of Washington in Seattle, reported increased strand breaks in DNA in rats' brains after rats were exposed to mobile phone frequencies,⁵ although some researchers are claiming not to be able to replicate the effect.

Meanwhile, in the UK, Dr Alan Preece at Bristol University reported in April that he



had observed an effect of mobile phone radiation on human cognition—specifically, the speeding up of a choice reaction test.⁶ However, given that he used 15 different tests on only two groups of 18 subjects exposed for two sessions of 30 minutes, the finding may easily have been a chance result. Also, the signal used did not exactly match that produced by a GSM phone—a deficit not helped by the derisory grant from the Department of Health of a mere £3,000!

By contrast, Dr John Tattersall, based at Porton Down Chemical and Biological Defence base in Wiltshire, funded to the tune of £113,000 by the DoH, recently reported effects of RF radiation of rats' hippocampal brain sections at non-thermal levels well below current NRPB guidelines.⁷ He observed changes in the electrically evoked potentials and in long-term potentiation that were not due to heating. Aside from his results, one has to ask why the DoH chose to give such a sum to Porton Down rather than award it on the open university marketplace where one can be reasonably assured that all results will be fully published.

Meanwhile, at Nottingham University, Dr David de Pomerai exposed nematode worms to microwaves from a Nokia 2110 phone and found that their cells produced high levels of "heat-shock proteins" (HSPs) at levels that did not produce a measurable temperature rise.⁸ HSPs are so-named because they were first observed to be produced in response to a considerable rise in temperature (at least 2°C), but in fact are produced whenever cells start to experience any damage to the protein structure in DNA and RNA.

One of the first studies that drew attention to possible radiation hazards was that by researchers at the Royal Adelaide Hospital in Australia, led by Dr Michael Repacholi.⁹ They found that 200

specially prepared mice, when exposed to pulsed 900 MHz radiation for one hour a day for 9 to 18 months, showed a highly significant doubling of B-cell lymphomas. At the time, the finding triggered controversy over its implications for human exposure. However, only now does it appear that an attempted replication is planned, which may or may not involve Dr Repacholi who currently heads the World Health Organization's EMF Project in Geneva.

NRPB GUIDANCE BASED ON SAR

Current NRPB and international guidance is based on the SAR, the specific absorption rate, which is a

measure of how much radiation is absorbed per gram of tissue over a given time. The NRPB focuses purely on preventing temperature rises exceeding 1°C, and bases its guidance on keeping any heating to less than 10 watts per kilogram (10 W/kg) in any 10 grams of tissue, averaged over 6 minutes. By contrast, the International Committee on Non-Ionising Radiation (ICNIRP) uses 2 W/kg—five times lower (the US uses 1.6 W/kg, but in 1 gram of tissue).

The Stewart Report has recommended that the UK fall into line with Europe and adopt the ICNIRP

levels in place of current NRPB guidelines, which is at least a step in the right direction—and an embarrassment to the NRPB.

However, the whole basis of using SAR as a reliable measure of exposure, given the complexities of the signal, has been questioned. At a special seminar held at the House of Commons in June 1999—with speakers including Professor Lai from the US and the UK's NRPB, including Professor Richard Doll, and attended by MPs and pressure groups—Professor Michael Kundi, of the Institute of Environmental Health at the University of Vienna, presented five basic assumptions in using the SAR for

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Table 1. Adjusted Odds Ratios (p<0.05) for calling time using GSM phone with reference to reported symptom. Reference category is calling time less than 2 minutes a day. (Source: K.-H. Mild et al., 1998)

<i>Duration (minutes per day)</i>	2-15	15-60	>60
Norway			
<i>Symptom:</i>			
Fatigue	1.10	1.55	4.14
Headache	1.94	2.69	6.31
Warmth behind ear	1.68	2.93	16.00
Warmth on ear	1.65	3.94	8.37
Burning skin	1.56	3.48	8.42
Sweden			
<i>Symptom:</i>			
Fatigue	1.25	1.80	1.40
Headache	1.49	2.50	2.83
Warmth behind ear	2.63	9.00	21.90
Warmth on ear	2.73	10.20	22.40
Burning skin	1.06	2.34	2.77

mobile phones, that can be scientifically challenged.¹⁰

The NRPB's position was further criticised in September 1999 when a House of Commons Select Committee Report also recommended that the NRPB reduce its exposure guideline levels to fall in line with those of the ICNIRP.¹¹ The NRPB rejected this advice at the time, but the pressure of the recent Stewart Report has finally proved impossible to resist.

ADVICE ON PROTECTIVE DEVICES

In the Select Committee Report, the British Medical Association's evidence to the Committee called for "prudent avoidance" and recommended that consumers should have access to protective devices to reduce radiation exposure.

Recently, *Which?*¹² published a report in which it claimed that research it had carried out showed that remote hands-free headsets tripled EMF exposure. However, the claimed results have been strongly criticised and *Which?* has been less than forthcoming in releasing its data and methodology. The research was actually carried out by ERA Technology in Leatherhead, Surrey, but they refuse to discuss the findings.

Which? has been strongly criticised and received threats of legal action if retractions were not made. Replications of certain tests are being planned and *Which?* is about to publish further studies that it claims will support its view.

Previous tests by others have found only a 15% to 30% increase in radiation into the ear, in a worst-case scenario. However, these devices are useful for keeping the radiation away from the body, and their instructions only emphasise advice to keep calls as short as possible.

Of those devices on the market, the two that have been subjected to the most research and testing are the Microshield and Tecno AO Antenna. The former is a barrier shield that tests show does significantly reduce radiation into the head, depending on what level of power the phone is using. The Tecno device aims to boost the body's ability to cope with the radiation and focuses more on the 217 Hz pulse, which tests show it does mitigate. Both companies can provide research to back their claims (Microshield, tel. +44 (0)208 3633333; Tecno distributor, tel. +44 (0)1227 832262).

I would strongly advise that mobile phone users, especially young people, use some sort of protection on their phones and keep calls as short as possible. Given the organs involved, it's just not worth the risk not to do so. I'm talking about cumulative, pulsed RF radiation going into your head, eyes and other organs every day for the rest of your life—and that's a long time!

Basic Definitions

- 1 hertz (Hz) = one cycle per second; 1 kilohertz (kHz) = 1,000 Hz; 1 megahertz (MHz) = 1,000,000 Hz; 1 gigahertz (GHz) = 1,000,000,000 Hz.
- The radiofrequency (RF) spectrum spans approximately 100 kHz to 300 MHz; the microwave (MW) spectrum spans 300 MHz to about 30 GHz.

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About the Author:

Simon Best, MA, is a medical journalist and is the co-author (with biophysicist Dr Cyril Smith) of the award-winning book *Electromagnetic Man: Health and Hazard in the Electrical Environment* (Dent, London, 1988; St Martins Press, NY, 1989).

Simon is also Editor (assisted by consultant Alasdair Phillips, director of Powerwatch UK) of the *Electromagnetic Hazard & Therapy* news report. Launched in 1989 and published four times a year, *EH&T* is

the only independent, regular news report in the UK covering research and debate on the health hazards of EM fields, as related to powerlines, VDUs, mobile phones/antenna masts, microwave sources, as well as their positive applications in orthodox and complementary medicine, including electrotherapy and magnetotherapy.

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Endnotes

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11. House of Commons Select Committee, "Mobile Phones and Public Health", Report No. 489. To obtain a copy (approx. £20 for the two volumes), telephone +44 (0)345 023474 (credit card orders) or write to: Stationery Office, Box 276, Publications Centre, London SW8 5TD, UK. Also visit website www.parliament.uk/commons/selcom and go to "Science and Technology Committee".
12. *Which?*, UK Consumers' Association, April 2000.